EXPRESS MAIL#EL568799874US

416 Rec'd PCT/PTO 15 JUN 2000

FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

ATTORNEYS DOCKET NUMBER
P00,1086

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S.APPLICATION NO. (if known, see 37 CFR 1 5)
09/581585

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE98/03676	December 15, 1998	December 15, 1997

TITLE OF INVENTION: **SURFACE MOUNTING OPTOELECTRONIC COMPONENT AND METHOD FOR PRODUCING SAME**

APPLICANT(S) FOR DO/EO/US: **GÜNTER WAITL, ROBERT LUTZ and HERBERT BRUNNER**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of International Application (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2).

7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)) **(attached at back of English translation of application)**.

9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report)**.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
    (SEE ATTACHED ENVELOPE)

13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☒ Other items or information:
    a. ☒ Submission of Drawings
    b. ☐ Request for Approval of Drawing Changes
    c. ☒ EXPRESS MAIL #EL568799874US

U.S.APPLICATION NO (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO	41C Rec'd PCT/PTO 15 JUN 2000 ATTORNEY'S DOCKET NUMBER
09/581585	PCT/DE98/03676	P00,1086

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO ..... $840.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) ... $760.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) ..... $450.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO ..... $1,250.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 98.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	20	- 20 =		X $ 18.00	$ 0.00	
Independent Claims	3	- 3 =		X $ 78.00	$ 0.00	
☐ Multiple Dependent Claims				$270.00 +	$ 0.00	
				TOTAL OF ABOVE CALCULATIONS =	$ 840.00	
☐ Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
				SUBTOTAL =	$ 840.00	
☐ Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	$	
				TOTAL NATIONAL FEE =	$	
☐ Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property				+	**SEE ATTACHED ENVELOPE**	
				TOTAL FEES ENCLOSED =	$ 840.00	
					Amount to be refunded	$
					charged	$

a. ☒ A check in the amount of $ 840.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **08-2290**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Hillaaa & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606

SIGNATURE

Melvin A. Robinson
NAME

31,870
Registration Number

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

AMENDMENT "A" PRIOR TO ACTION

APPLICANT(S):	Günter Waitl et al.
ATTORNEY DOCKET NO.:	P00,1086
INTERNATIONAL APPLICATION NO.:	PCT/DE98/03676
INTERNATIONAL FILING DATE:	15 December 1998
INVENTION:	"SURFACE MOUNTING OPTOELECTRONIC COMPONENT AND METHOD FOR PRODUCING SAME"

Assistant Commissioner for Patents

Washington, D.C. 20231

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination in the United States National Examination Phase.

IN THE SPECIFICATION:

On page 1, cancel the title above line 3, and insert the following above line 3:

--TITLE

SURFACE MOUNTING OPTOELECTRONIC COMPONENT AND METHOD FOR PRODUCING SAME

BACKGROUND OF THE INVENTION--;

in line 3, after "The" insert --present--;

in line 5, after "in" insert --a--;

in line 13, cancel "mounting" substitute --mounted-- therefor;

in line 15, cancel "EP 0 230 336 A1" substitute --European Patent Application No. 0 230 336-- therefor;

in line 22, cancel "EP" substitute --European Patent Application No.-- therefor.

On page 2, below line 15, insert a centered heading:

--**SUMMARY OF THE INVENTION**--;

in line 18, after "The" insert --present--;

cancel lines 21-22, substitute the following at line 21:

-- This object is achieved in accordance with the present invention in a method for producing a surface mounting optoelectronic component having a base body, an optoelectronic transmitter/receiver that is arranged in a recess of the base body, and an optical device that covers the recess, said method comprising the steps of: preparing the base body with the optoelectronic transmitter/receiver arranged in the recess; filling the recess of the prepared base body with a transparent hardenable casting compound; then placing the optical device onto the as yet uncured casting compound; and then curing the casting compound.

In an embodiment, the step of preparing the base body comprises the steps of: coating a conductor strip with a thermoplast housing while simultaneously forming the recess of the base body into a top surface of the thermoplast housing, a portion of said conductor strip being situated inside the recess; mounting the optoelectronic transmitter/receiver on said portion of the conductor strip situated inside the recess; and filling the recess of the base body with a transparent curable casting compound having thermal characteristics adapted to the thermoplast housing material.

In an embodiment, the recess of the base body is filled with the casting compound to a level such that, during the subsequent placement of the optical device, essentially no casting compound runs over an edge of the recess.

In an embodiment, the recess is filled with casting compound essentially to the edge of the recess such that, after the recess is filled with casting

compound, a fillet develops owing to the surface tension of the casting compound; and the optical device has a shape in a region contacting the casting compound that no casting compound runs over the edge of the recess when the optical device is subsequently placed onto the casting compound.

In an embodiment, the optical device is placed from above, without pressure, onto one of the base body or at least one seating element attached to said base body within said recess.

In an embodiment, the casting compound is cured by the influence of heat.

In an embodiment, prior to filling the recess, an optical device is produced by one of casting, pressing, or injection processing; then the optical device is readied and transported as bulk material of optical devices; then a respective optical device is automatically picked from the bulk material; and then the picked optical device is automatically positioned over the base body.

This object is also achieved in accordance with the present invention in a method for producing a surface mounting optoelectronic component having a base body, an optoelectronic transmitter/receiver that is arranged in a recess of the base body, and an optical device that covers the recess, said method comprising the steps of: preparing the base body with the optoelectronic transmitter/receiver arranged in the recess; then filling the recess of the prepared base body with a first transparent hardenable casting compound; then readying a casting mold half and filling the mold half with a second transparent hardenable casting compound; then at least partially curing at least one of the first casting compound in the recess of the base body and the second casting compound in the mold half; then casting the optical device onto the base body by joining the base body and the mold half properly positioned, such that second casting compound in the mold half comes into contact with a surface of the first casting compound in the recess of the base body; then curing at least one of the second and first casting compound; and then removing the mold half from the base body with the cast-on optical device.

In an embodiment, the method further comprises, prior to joining the

base body and the mold half, wetting the surface of the first casting compound.

In an embodiment, the step of wetting the surface of the first casting compound comprises the steps of: turning the base body about a horizontal axis such that an opening of the recess is directed downwardly; and at least superficially immersing the base body in liquid casting compound.

In an embodiment, the at least partial curing of the first casting compound is by heat treatment.

In an embodiment, the at least partial curing of the second casting compound is by heat treatment.

In an embodiment, the method further comprises the steps of: leading a number of base bodies on a first strip; and leading a number of mold halves on a second strip, wherein the first strip and the second strip are led in parallel at least during the step of casting the optical device onto the base body.

In an embodiment, the method further comprises the steps of: leading a number of base bodies on a first strip; combining a number of mold halves in a group; and connecting the group of mold halves, such that they can be detached, to a corresponding number of base bodies at least during the step of casting the optical device onto the base body.

In an embodiment, the base body and the mold half are joined at a temperature of approximately 80°C.

In an embodiment, the second casting compound is cured at a temperature of approximately 150°C.

In an embodiment, the mold half is removed from the base body at a temperature of approximately 80°C.

This object is also achieved in accordance with the present invention in a surface mounting optoelectronic component comprising:

a base body having a thermoplast injection housing and a coated conductor strip secured to the housing, said base body having a recess formed therein with a portion of the conductor strip situated inside the recess;

an optoelectronic transmitter/receiver arranged in the a recess of the base body and mounted on the portion of the conductor strip situated inside the

recess;

a transparent hardenable casting compound provided in the recess, said casting compound having thermal characteristics adapted to those of the thermoplast housing material; and

an optical device covering the recess and cast onto the casting compound such that a seating surface of the optical device is in surface-wide contact with the casting compound.

In an embodiment, the recess comprises a ring channel surrounding the recess.

In an embodiment, the base body comprises a number of seating elements for seating of the optical device, said seating elements being arranged at a margin side relative to the recess.--.

On page 3, in line 9, after "The" insert --present--;
in line 12, after "The" insert --present--;
in line 18, after "the" insert --present--.

On page 4, in line 4, after "case" insert a comma;
in line 5, after the comma insert --thus--;
in line 15, cancel "depositing [sic]" substitute --placement-- therefor;
in line 16, cancel "In a further advantageous variant of the method" substitute --In an embodiment-- therefor.

On page 5, in line 3, preceding "inventive" insert --present--;
in line 11, cancel "Lastly" substitute --Last-- therefor;
cancel lines 22-29, substitute the following at line 22:
--automation, enabling mass production on an industrial scale.
These and other features of the invention(s) will become clearer with reference to the following detailed description of the presently preferred embodiments and accompanied drawings.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a base body with housing and conductor strip as used in the present inventive method.--.

On page 6, in line 1, cancel "Figure 2A,2B,2C" substitute --Figures 2A, 2B and 2C show-- therefor;

in line 4, cancel the semicolon substitute a period therefor;

in line 5, after "Figure 3" insert --is--;

in line 6, cancel the semicolon substitute a period therefor;

in line 7, after "Figure 4" insert --is--;

in line 8, cancel the semicolon substitute a period therefor;

in line 9, after "Figure 5" insert --shows--;

in line 10, cancel the semicolon substitute a period therefor;

in line 11, after "Figure 6" insert --is--, and cancel "; and" substitute a period therefor;

in line 12, after "Figure 7" insert --is--;

below line 13, insert a centered heading:

--**DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS**--;

in line 24, after "recess" insert --4--.

On page 7, in line 11, cancel "2b" substitute --2B-- therefor, and cancel the space before the comma;

in line 20, after "housing" insert --3'--, and after "compound" insert --14--;

in line 29, after "compound" insert --14--.

On page 8, in line 6, after "lens" insert --16--, and after "housing" insert --3'--;

in line 7, after "slope" insert --18--;

in line 15, after "housing" insert --3'--;

in line 16, after "housing's" insert --3'--;

in line 18, after "compound" insert --14--.

On page 9, in line 1, preceding "inventive" insert --present--, and after "method" insert a comma;

in line 7, cancel "mld [sic]" substitute --mold-- therefor;

in line 13, after "container" insert --30--.

On page 10, in line 9, after "Figure" insert --6--;

in line 16, after the first occurrence of "compound" insert --14--, and after the second occurrence of "compound" insert --14--;

in line 18, after "compound" insert --14--;

in line 22, preceding "inventive" insert --present--;

in line 28, after "effects" insert --35--.

On page 11, in line 1, after "housing" insert --3--;

in line 14, after "treatment" insert --43--.

On page 12, in line 12, cancel "automatization" substitute --automation-- therefor;

below line 12, insert the following paragraph:

-- Although modifications and changes may be suggested by those of ordinary skill in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.--.

IN THE CLAIMS:

On page 13, in line 1, cancel "Patent Claims" substitute --**WE CLAIM AS OUR INVENTION:**-- therefor.

Please cancel claims 1-20.

Please add the following new claims 21-40:

21. A method for producing a surface mounting optoelectronic component having a base body, an optoelectronic transmitter/receiver that is arranged in a recess of the base body, and an optical device that covers the recess, said method comprising the steps of:

preparing the base body with the optoelectronic transmitter/receiver arranged in the recess;

filling the recess of the prepared base body with a transparent hardenable casting compound;

then placing the optical device onto the as yet uncured casting compound; and

then curing the casting compound.

22. The method as claimed in claim 21, wherein the step of preparing the base body comprises the steps of:

coating a conductor strip with a thermoplast housing while simultaneously forming the recess of the base body into a top surface of the thermoplast housing, a portion of said conductor strip being situated inside the recess;

mounting the optoelectronic transmitter/receiver on said portion of the conductor strip situated inside the recess; and

filling the recess of the base body with a transparent curable casting compound having thermal characteristics adapted to the thermoplast housing material.

23. The method as claimed in claim 21, wherein the recess of the base body is filled with the casting compound to a level such that, during the subsequent placement of the optical device, essentially no casting compound runs over an edge of the recess.

24. The method as claimed in claim 23, wherein the recess is filled with casting compound essentially to the edge of the recess such that, after the recess is filled with casting compound, a fillet develops owing to the surface tension of the casting compound; and wherein the optical device has a shape in a region contacting the casting compound that no casting compound runs over the edge of the recess when the optical device is subsequently placed onto the casting compound.

25. The method as claimed in claim 21, wherein said optical device is placed from above, without pressure, onto one of the base body or at least one seating element attached to said base body within said recess.

26. The method as claimed in claim 21, wherein the casting compound is cured by the influence of heat.

27. The method as claimed in claim 21, further comprising the steps of:

prior to filling the recess, producing an optical device by one of casting, pressing, or injection processing;

then readying and transporting the optical device as bulk material of optical devices;

then automatically picking a respective optical device from the bulk material; and

then automatically positioning the picked optical device over the base body.

28. A method for producing a surface mounting optoelectronic component having a base body, an optoelectronic transmitter/receiver that is arranged in a recess of the base body, and an optical device that covers the recess, said method comprising the steps of:

preparing the base body with the optoelectronic transmitter/receiver arranged in the recess;

then filling the recess of the prepared base body with a first transparent hardenable casting compound;

then readying a casting mold half and filling the mold half with a second transparent hardenable casting compound;

then at least partially curing at least one of the first casting compound in the recess of the base body and the second casting compound in the mold half;

then casting the optical device onto the base body by joining the base body and the mold half properly positioned, such that second casting compound in the mold half comes into contact with a surface of the first casting compound in the recess of the base body;

then curing at least one of the second and first casting compound; and

then removing the mold half from the base body with the cast-on optical device.

29. The method as claimed in claim 28, further comprising the steps of:

prior to joining the base body and the mold half, wetting the surface of the first casting compound.

30. The method as claimed in claim 29, wherein the step of wetting the surface of the first casting compound comprises the steps of:

turning the base body about a horizontal axis such that an opening of the recess is directed downwardly; and

at least superficially immersing the base body in liquid casting compound.

31. The method as claimed in claim 28, wherein the at least partial curing of the first casting compound is by heat treatment.

32. The method as claimed in claim 28, wherein the at least partial curing of the second casting compound is by heat treatment.

33. The method as claimed in claim 28, further comprising the steps of:

leading a number of base bodies on a first strip; and

leading a number of mold halves on a second strip,

wherein the first strip and the second strip are led in parallel at least during the step of casting the optical device onto the base body.

34. The method as claimed in claim 28, further comprising the steps of:

leading a number of base bodies on a first strip;

combining a number of mold halves in a group; and

connecting the group of mold halves, such that they can be detached, to a corresponding number of base bodies at least during the step of casting the optical device onto the base body.

35. The method as claimed in claim 28, wherein the base body and the mold half are joined at a temperature of approximately 80°C.

36. The method as claimed in claim 28, wherein the second casting compound is cured at a temperature of approximately 150°C.

37. The method as claimed in claim 28, wherein the mold half is removed from the base body at a temperature of approximately 80°C.

38. A surface mounting optoelectronic component comprising:

a base body having a thermoplast injection housing and a coated conductor strip secured to the housing, said base body having a recess formed therein with a portion of the conductor strip situated inside the recess;

an optoelectronic transmitter/receiver arranged in the a recess of the base body and mounted on the portion of the conductor strip situated inside the recess;

a transparent hardenable casting compound provided in the recess, said casting compound having thermal characteristics adapted to those of the thermoplast housing material; and

an optical device covering the recess and cast onto the casting compound such that a seating surface of the optical device is in surface-wide contact with the casting compound.

39. The surface mounting optoelectronic component as claimed in claim 38, wherein the recess comprises a ring channel surrounding the recess.

40. The surface mounting optoelectronic component as claimed in claim 38, wherein the base body comprises a number of seating elements for seating of the optical device, said seating elements being arranged at a margin side relative to the recess.

IN THE ABSTRACT:

On page 19, cancel lines 1-3, insert the following centered heading at line 1:

--**ABSTRACT OF THE DISCLOSURE**--;

in line 5, cancel "comprises" substitute --having-- therefor;

in line 9, cancel "whereby" substitute --so that-- therefor;

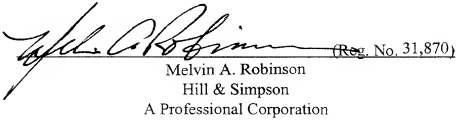
cancel line 11.

REMARKS:

The present Amendment revises the specification, drawings and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. All of the changes are editorial and no new matter is added thereby. Claims 1-20 have been canceled. New claims 21-40 are patentably distinguishable from the known prior art.

Early examination on the merits is respectfully requested.

Respectfully submitted,



(Reg. No. 31,870)

Melvin A. Robinson
Hill & Simpson
A Professional Corporation
85th Floor - Sears Tower
Chicago, Illinois 60606
(312) 876-0200 ext. 3899
Attorneys for Applicant(s)

Surface Mounting Optoelectronic Component and Method For Producing Same

The invention relates to a method for producing a surface mounting optoelectronic component comprising a base body, an optoelectronic transmitter and/or receiver that is arranged in recess of the base body, and an optical device that occludes the recess, as well as to a surface mounting optoelectronic component.

In recent years, surface mounting technology (SMT) has increasingly supplanted the equipping of conductor carriers with wired components. The crucial advantage of SMT is an increase in packing density, which cannot be achieved by conventional insertion methods.

Due to the high packing density, which is desirable in many optical applications, SMT is particularly important in the field of optoelectronics. There are already known optoelectronic components which are designed to be surface mounting in accordance with the SMT concept.

EP 0 230 336 A1 describes a surface mounting optoelectronic component that comprises an annular housing, the upper opening of which is sealed by a ball lens, while the lower opening of the ring stands on a printed circuit board. Inside the housing, a light-emitting semiconductor element is arranged between the circuit board and the bottom vertex of the ball lens. The interior space of the ring housing, which is defined by the surface of the printed board and the ball lens, is filled with a transparent glue.

Another surface mounting optoelectronic component is illustrated in EP 0 400 176. This component has a base body with a central depression in which an optically active semiconductor element is arranged. Above the base body, there is a lens, which is connected to the base body via a fixing mechanism such as a clamping peg.

"Siemens SMT-TOPLED für die Oberflächenmontage"(Frank Möllmer and Günter Waitl, *Siemens Components 29* (1991), Vol. 4:147-149) teaches a light emitting diode (LED) which is provided for surface mounting. To produce this diode,

a continuously stamped conductor strip is coated with a thermally stable thermoplast, forming the housing frame. In the inner region of the housing frame, an optically active element is mounted on the conductor strip and electrically contacted to interconnects there. Next, the frame's interior region for guarding the active element against environmental influences is cast using a casting resin. A lens or similar optical device is not provided in this component.

The SMT opto-components described in the documents cited above have the unique attribute that first the whole component housing is produced by coating a conductor strip with a thermoplast material, and the opto-electronic transmitter and/or receiver is inserted into the thermoplast housing only after this is produced. The advantages of this method of production are that a very economical mass production at the belt (conductor strip) is possible, and low structural heights and standardized basic structural forms are easy to realize. Due to their low costs, these prehoused SMT opto-components, as they are called, are used above all in display arrays and the like.

It is the object of the present invention to set forth a method by which the emission characteristic of opto-electronic SMT components of the above type can be improved without raising the component costs unacceptably. The invention is also directed to designing this type of optoelectronic SMT component with a well definable emission characteristic and simultaneously low component costs.

This object is achieved by a method with the features of claim 1 or claim 8 and by an optoelectronic component with the features of claim 18.

Following the production of the base body with the optoelectronic transmitter and/or receiver arranged in the recess, the recess of the base body is filled with a transparent hardenable casting compound, and the optical device is attached to the base body, said optical device being brought into contact with the casting compound in the region of the recess before the casting compound and/or the optical device (if this also comprises a casting compound) has completely hardened.

An essential aspect of the present invention is that the optical device is placed on the base body only after the recess is poured with casting compound. Because the optical device is placed onto the recess when the latter is already filled with casting compound, the optical device can be positioned on the base body extremely precisely and reproducibly, and this positioning remains essentially unaffected by subsequent steps such as curing or removal from the mold. This guarantees a high optical quality of the optoelectronic component with respect to the emission behavior or reception behavior, which is very important for applications in which an exact beam guidance and a high light yield are desirable. The inventive optoelectronic components are thus superior to components in which the recess is filled from the reverse side given a previously mounted optical device.

The inventive method can be applied particularly advantageously in the production of what are known as prehoused optoelectronic components. Here, the base body is produced first by coating a conductor strip with a thermoplast while the housing with the recess is simultaneously formed, and then the optoelectronic transmitter and/or receiver is assembled on a section of the conductor strip that resides in the recess.

In accordance with a first, particularly advantageous embodiment of the inventive method, the optical device is placed on the as yet unhardened casting compound, and the casting compound is then cured.

In this case, the fill level of the casting compound can be selected such that casting compound does not escape over the edge of the recess when the optical device is placed on. It is then unnecessary to take measures to trap casting compound that may overflow.

It is also possible to exploit a fillet formation of the casting compound, which arises on the basis of its surface tension. In this case, an optical device is used whose shape in its region that contacts the casting compound is selected such that, even when the recess is filled to the edge with casting compound, said casting

compound does not overflow the edge of the recess when the optical device is placed on.

The base body can also be provided with a ring channel that surrounds the recess before the optical device is placed on. In this case casting compound that may overflow when the optical device is placed on is collected in the ring channel, preventing it from running down on the exterior of the base body and hardening there, which would impair the manipulability of the component.

A particularly reproducible positioning of the optical device is achieved when, prior to the placement of the optical device, the base body is provided with seating elements that are arranged at the margin side relative to the recess. The seating elements can be formed integrated with the housing in the above described injection step for producing the base body for a prehoused optoelectronic component.

Preferably, the optical device is placed from above onto the base body, or the seating elements that have been fashioned thereon, without pressure. The depositing **[sic]** of the optical device then occurs by means of gravity alone.

In a further advantageous variant of the method, the optical device is first produced by means of a casting, pressing or injection procedure before the optical device is placed on, and then it is transported in bulk and placed onto a base body by automatic picking from the bulk material and automatic positioning over said base body. The advantage of these measures is that the optical device is produced completely independently of the production of the base body, opening up the possibility to control the quality of the optical device effectively and distinctly and to eliminate spoilage. This makes it possible to produce components of the highest quality.

In a second particularly preferred embodiment of the inventive method, the optical device is formed in a casting process, and in the scope of this casting process it is placed onto the base body in the region of the recess and is cast out with the casting compound in the recess. Also, in this second embodiment of the inventive method, the recess of the base body is filled before the optical device is placed on in

the scope of said pouring process, so that the advantages associated with this procedure are also manifest in this embodiment of the invention.

In this second embodiment of the inventive method for producing the optical device, one half of a casting mold is advantageously prepared first, and this half is filled with an additional casting compound. On the other hand, when the recess of the base body has been filled with casting compound, the casting compound is first hardened at least partially and is then wetted with casting compound. Next, the base body and the half of the casting mold which is filled with the additional casting compound are joined, under correct positioning, and in a following step the additional casting compound in the casting mold half is cured, whereby it is cast onto the casting compound in the recess of the base body. Lastly, the now finished optoelectronic component is ejected by removing the half of the casting mold from the base body with the optical device that has been cast on.

Wetting can be accomplished by turning the base body about a horizontal axis and immersing it in casting compound at least on the surface, for example. Because of the at least partial hardening of the casting compound, none of the compound escapes during the turning process.

The wetting of the surface of the casting compound prevents air bubbles from remaining in the casting compound in the subsequent casting on process.

The advantage of the described second embodiment of the inventive method is that it is particularly easy to realize and has a high potential for automatization, enabling a mass productions **[sic]** on an industrial scale.

Further advantageous developments of the inventive method are laid out in the subclaims 2 to 7, or respectively, 9 to 17, and of the inventive component, in subclaims 19 and 20.

The invention is exemplified below with reference to the drawings, in which are shown:

Figure 1 a perspective view of a base body with housing and conductor strip as used in the inventive method;

Figure 2A,2B,2C the steps of preparing the base body, filling the recess of the base body, and placing the optical device onto the base body in accordance with a first embodiment of the present invention using the example of the base body illustrated in Figure 1;

Figure 3 the optoelectronic component represented in Figure 2C, as produced in accordance with the first inventive embodiment, in a plan view;

Figure 4 a schematic view explicating the production and transport of the optical device;

Figure 5 another optoelectronic component which is produced in accordance with the first embodiment of the inventive method;

Figure 6 a plan view of the optoelectronic component illustrated in Figure 5; and

Figure 7 a schematic representation explicating a second embodiment of the inventive method.

Figure 1 shows a base body 1, which is formed by coating a conductor strip 2 with a high-temperature thermoplast housing 3. The housing 3 advantageously has flat exterior surfaces, guaranteeing easy insertion. At the surface, a recess 4 is provided in the housing 3.

Figure 2A shows a sectional illustration of a base body 1 that is constructed essentially in accordance with Figure 1, the housing 3' differing from the housing 3 illustrated in Figure 1 only to the extent that the surface 5 of the housing 3' is provided with a ring groove 6 that surrounds the recess 4, which will be mentioned later. Figure 2A shows that sections 7,8 of the conductor strip 2 are surrounded by the thermoplast housing 3' and protrude with contact portions 9,10 into the recess 4 in the bottom region of said recess. A contact portion 9 is extended up to the central region of the recess 4.

The inner wall surfaces 13 of the housing 3 are constructed as oblique surfaces and form a reflector. By selecting a housing material with a high diffuse degree of reflection of approximately 90% or more, a high reflectivity of these surfaces 13 is generated.

Following the production of the conductor strip housing structure 2,3', a semiconductor chip 11 is mounted in the recess 4 of the housing 3'. In the representation in Figure 2A, this assembly step has already been performed. The semiconductor chip 11 is placed onto the extended contact portion 9 of the conductor strip 2 and electrically contacted to this. An additional electrical contacting occurs via a wire 12, which is led from the semiconductor chip 11 to the opposite contact portion 10 of the conductor strip 2. As semiconductor chip 11, a light-emitting diode or a photosensitive semiconductor element can be used, for example.

Following the assembly and contacting of the semiconductor chip 11, the recess 4 is filled with a free-flowing casting compound 14 in accordance with the illustration in Figure 2b. The casting compound 14 can be a matter of an epoxy resin , for example. The casting compound 14 and the housing material are matched with respect to thermal properties in order to prevent thermal loads, such as may arise in the soldering of the component and in later use, from causing mechanical failures.

Due to the surface tension of the casting compound, its surface 15 is fashioned in the shape of a fillet; that is, it has a concave course.

The fill level of the casting compound 14 depends on the dimension of the fillet formation, the shape of the optical device that is placed onto the recess 4 in the next step (see Figure 2C), and also on whether measures have been taken at the housing to trap casting compound that may overflow the edge, such as the surrounding ring groove 6 that is illustrated here.

Figure 2C illustrates the subsequent placement of an optical device onto the recess 4. In the example illustrated in Figure 2C, the optical device is realized in the form of a plane-convex convergent lens 16. On the side facing the recess 4, in the center region the convergent lens 16 has a flat base surface 17, which continues via a lead-in slope into a radially outlying annular seating surface 19. The base surface 17 is coplanar with the seating surface 19.

In the placing of the lens 16 onto the housing 3, which has been filled with casting compound in accordance with Figure 2B, the lens 16 is first positioned over

the recess 4 and aligned with it axially. Next, the lens 16 is lowered onto the thermoplast housing 3', whereby the lead-in slope 18 of the lens 16 and a top region of the inclined surface 13 of the inner wall of the reflector interact for self-centering. As a result, the achieved end position of the lens 16 relative to the housing 3' is largely independent of the preceding alignment step and is determined essentially by the dimensional stability of the lens and housing production in the corresponding regions of the slope surface.

The lens 16 is placed on the housing 3' as follows: First, the lens's base surface 17 is brought into contact with the surface 15 of the casting compound 14. At this time, the seating surface 19 is not yet seated on the surface 5 of the housing 3'. The subsequent lowering of the lens 16 into the final position can be effectuated by the influence of gravity alone. This entails a surface-wide contact of the base surface 17 of the lens with casting compound 14 and, depending on the fill level of the recess 4 (Figure 2B), a displacing of casting compound 14 from the recess 4. Casting compound that overflows the edge of the housing collects in the ring groove 6. The ring groove 6 thus prevents casting compound from flowing out down the housing's outer wall, which would otherwise be possible. A certain overflow of casting compound into the ring groove 6 can thus be thoroughly desirable, since this favorably affects the closeness of the joint between the lens 16 and the housing 3'.

In a final step of production, the casting compound 14 is hardened in the component, for instance in the scope of a heat treatment.

Figure 3 shows a plan view of the optoelectronic component illustrated in Figure 2C. The oblique surfaces 13 of the wall of the recess 4 that form the reflector, and the semiconductor chip 11, are located under the lens 16 and are represented by broken lines. The optional ring groove 6 is not included in the illustration for reasons of simplicity.

The method detailed with the aid of Figures 2A to 2C can be carried out using lenses of various types and materials. It is essential, however, that in this

embodiment of the inventive method the production of the lenses is already concluded before they are placed on the housing 3, 3'.

Figure 4 details an example of the production of the plane-convex convergent lens 16 illustrated in Figure 2C by a transfer molding process that is carried out in a press tool 20. In this process, clear pressing compound is first pressed in the direction of the arrow 21 through a channel 22 of a heated half 23 of the tool into a press mld **[sic]** which is defined by a mold surface 24 of the first half of the tool, a mold surface 26 of a second half 25 of the tool, which is situated adjacent the first half 23, and to the face surface 27 of a ring ejector 28 that has been displaceably accepted in the second tool half 25. The pressing compound is then formed by a pressing process into the lens 16, which is then pushed out of the press tool 20 by means of the ring ejector 28 in the direction of the arrow 29 in a hot state with a stable form. The lens 16 then drops into a lens collection container as bulk material. The lens collection container 30 is connected to transport mechanisms, such as a shaker conveyor, funnels, and so on (which are not illustrated), via which the lens 16 is moved to an assembly unit (also not illustrated), by means of which it is placed on the housing 3 of the optoelectronic component in the described manner (see Figure 2C).

In the lens production method described in accordance with Figure 4, it has proven advantageous that only very low tolerances arise. As a result, on one hand, the spoilage is minimized, and on the other hand, the dimensional stability of the lens 16 favorably affects both the optical characteristics of the lens 16 and the reproducibility of the final position of the lens 16 in the housing 3, 3'.

A modification of the optoelectronic component illustrated in Figure 2C is shown in Figure 5. The component in Figure 5 differs from that in Figure 2C essentially in having a ball lens 16' of diameter R instead of the plane-convex lens 16.

The component illustrated in Figure 5 is produced by a method analogous to the steps represented in Figure 2A to Figure 2C. The self-centering of the ball lens 16 during placement onto the housing 3' is effectuated by its surface curvature. During placement of the lens 16', the ball portion 31 that protrudes into the recess 4 comes into

contact with the casting compound 14. By selecting the fill level and/or the radius R of the lens 16' appropriately, a precise correlation can be achieved between the course of the surface of the ball portion 31 in its inserted state and the convex course of the casting compound surface 15. In this case, in essence no casting compound is displaced during placement of the lens 16'. An additional advantage of the rounded ball portion 31 is that it guarantees that air bubbles cannot remain between the casting compound surface 15 and the lens 16' in the assembly process.

Figure 6 shows a plan view of the component illustrated in Figure 5 with ball lens 16'. This Figure shows that radial ridges are fashioned on the oblique inner wall surfaces 13 of the recess 4, which serve as seating surfaces for the ball lens 16'.

On one hand, the radial ridges 32 bring about a definite and stable three-point seating of the ball lens 16', which further enhances the reproducibility of the installation position of the ball lens 16' relative to the housing 3'. On the other hand, the radial ridges 32 create an annulus type free area between the inner surface 13 of the recess 4 and the ball portion 31, which area can serve as an accepting volume for displaced casting compound, so that the casting compound can be prevented from overflowing the edge of the recess even in case of a marked displacement of casting compound.

Radial ridges 32 or similar seating elements can also be provided given other lens shapes , and particularly given the plane-convex lens 16 used in accordance with Figure 2C.

Figure 7 details a second embodiment of the inventive method. The main difference between the two embodiments is that in the second embodiment the optical device is attached to the component housing 3 in a casting process.

Housings 3 that have been provided with an optical semiconductor chip 11 (see Figure 1) are fed on a first strip 33 to a casting station 34, in which the recess 4 of the component housing 3 is cast. Next, a curing or at least partial curing of the casting compound is carried out by thermal effects. At 36 the strip 33 is turned 180°, and at 37

the cast surface of the housing, now directed downward, is immersed in casting resin for prewetting same.

The wetting of the hardened or cured-on casting compound can also be accomplished some other way. The wetting guarantees that the subsequent casting process ensues without air bubbles.

A second strip 38 carries casting mold halves 39 which are provided for producing the optical device. To this end, the mold halves 39 are filled with a casting resin in a lens casting station 40. The first strip 33 with the housings 3 facing down, and the second strip 38 with the filled casting mold halves 39, are led together through the gap between two hedgehog wheels 41, which are arranged axis-parallel, and are merged in the gap. The hedgehog wheels 41 are heated, so that a temperature of approx. 80°C prevails in the gap. After leaving the gap, the combination housing/ mold halves 3, 39 undergoes heat treatment 43 at aprox. 150° C under the influence of a mechanical guidance 42. The effect of the heat treatment is that casting material that is respectively present in the casting mold halves 39 is poured onto the surface of the casting compound at the housing side and cures onto this surface. The two strips 33, 38 traverse the gap of a second pair of hedgehog wheels 44, which is likewise kept at a temperature of 80°C. The ejection of the component with the cast-on optical device 45 from the mold is accomplished at the output side of the second pair of hedgehog wheels 44 by diverging the two strips 33 and 38.

The method illustrated in Figure 7 can be modified as follows:

Instead of on a strip, a predetermined number of n casting mold halves can be combined integrally in a pallet type group of casting molds. Following a corresponding pretreatment in accordance with Figure 7, the group of casting molds which are filled with casting compound are led to the strip 33 from below such that each mold half of the group comes into contact with a housing 3 that is arranged on the strip 33. They can be held together by clamping, for instance. The strip 33 with the clamped-on casting mold group then undergoes a heat treatment 43 at approx. 150° C similarly to the double strip structure in Figure 7. Following successful curing, the

entire casting mold group is removed from the strip 33 in the scope of the ejection process.

The latter method employing a casting mold group has the advantage over the double-strip method illustrated in Figure 7 that the casting mold groups that are used can be reused some 200 to 300 times, while the casting mold halves 39 that are conveyed on the strip 38 generally must be replaced after a few usages. Besides this, greater positioning accuracy is achieved by the integral design and thus stable arrangement of the casting molds in the group, so that the optoelectronic components that are produced by this method generally satisfy higher quality requirements.

On the other hand, the double-strip method illustrated in Figure 7 has the advantage that it can be carried out very cost-effectively due to the high degree of automatization.

Patent Claims

1. Method for producing a surface mounting optoelectronic component with a base body (1), an optoelectronic transmitter and/or receiver (11) that is arranged in a recess (4) of the base body (1), and an optical device (16,16',45) that covers the recess (4), with the steps:

a) preparing the base body (1) with the optoelectronic transmitter and/or receiver arranged in the recess,

b) filling the recess (4) of the base body (1) with a transparent hardenable casting compound (14),

c) placing the optical device (16,16') on,

characterized in that

the optical device (16,16') is placed onto the as yet uncured casting compound (14) in step (c), and the casting compound (14) is then cured.

2. Method as claimed in claim 1, characterized by the steps:

- producing the base body (1) by coating a conductor strip (2) with a thermoplast housing (3) while simultaneously forming the recess (4),
- mounting the optoelectronic transmitter and/or receiver (11) on a portion (9) of the conductor strip (2) situated inside the recess (4),
- filling the recess (4) of the base body (1) with a transparent curable casting compound (1) whose thermal characteristics are adapted to the thermoplast housing material.

3. Method as claimed in claim 1 or 2,

characterized in that

in step b), the fill level of the casting compound (14) is selected such that, in the subsequent placement of the optical device (16,16') in step d), essentially no casting compound (14) runs over the edge of the recess (4).

4. Method as claimed in claim 3,
characterized in that
the recess (4) is filled with casting compound (14) essentially to the edge in step b), and after the recess (4) is filled a fillet (15) develops owing to the surface tension of the casting compound (14), and the optical device (16,16') is so shaped in the region (31) contacting the casting compound (14) that no casting compound (14) runs over the edge of the recess (4) when the optical device (16,16') is subsequently placed on.

5. Method as claimed in one of the preceding claims,
characterized in that
in step c) the optical device (16,16') is placed from above onto the base body (1) or onto the seating elements (32) attached thereto essentially without pressure.

6. Method as claimed in one of the preceding claims,
characterized in that
the curing process ensues under the influence of heat.

7. Method as claimed in one of the preceding claims,
characterized in that
prior to step b) the following steps are carried out:
- production of the optical device (16,16') by mean of casting, pressing or injection processes,
- readying and transporting the optical devices (16,16') as bulk material,
- automatic picking of a respective device (16,16') from the bulk material, and
- automatic positioning of an optical device (16,16') over a base body (1).

8. Method for producing a surface mounting optoelectronic component with a base body (1), an optoelectronic transmitter and/or receiver (11) that is arranged in a recess

(4) of the base body (1), and an optical device (45) that covers the recess (4), with the steps:

A) preparing the base body (1) with the optoelectronic transmitter and/or receiver arranged in the recess,

B) filling the recess (4) of the base body (1) with a first transparent hardenable casting compound (14),

C) readying a casting mold half (39) and filling the half (39) with a second transparent hardenable casting compound,

D) at least partially curing (35) the first casting compound (14) in the recess (4) of the base body (1) and/or the second casting compound in the mold half (39),

E) joining the base body (1) and the mold half (39) properly positioned, in such a way that the additional casting compound that is present in the mold half (39) comes into contact with a surface of the casting compound (14) in the recess (4) of the base body (1),

F) curing the second and/or first casting compound, and

G) removing the mold half (39) from the base body (1) with cast-on optical device (45).

9. Method as claimed in claim 8,

characterized in that

prior to step E), the surface of the casting compound (14) is wetted.

10. Method as claimed in claim 9,

characterized in that

the step of wetting the surface of the casting compound (14) subsumes the steps:

- turning (36) the base body (1) about a horizontal axis such that the opening of the recess (4) is directed down, and
- immersing (37) the base body (1) in liquid casting compound at least superficially.

11. Method as claimed in one of the claims 8 to 10,
characterized in that
the at least partial curing of the casting compound (14) is carried out by heat treatment (35).

12. Method as claimed in one of the claims 8 to 11,
characterized in that
the curing of the additional casting compound is carried out by heat treatment (43).

13. Method as claimed in one of the claims 8 to 12,
characterized in that
- several base bodies (1) are led on a first strip,
- that several mold halves (39) are led on a second strip (38), and
- that the first (33) and second (38) strips are led in parallel at least during the casting on process in step c).

14. Method as claimed in one of the claims 8 to 13,
characterized in that
- several base bodies (1) are led on a first strip,
- that several mold halves (39) are combined in a group, and
- that the group of casting molds is connected, in such a way that they can be detached, to a corresponding number of base bodies (1), at least during the casting on process in step E).

15. Method as claimed in one of the claims 8 to 14,
characterized in that
the base body (1) and the casting mold half (39) are joined at a temperature of approximately 80°C.

16. Method as claimed in one of the claims 8 to 15,
characterized in that
the additional casting compound is cured (43) at a temperature of approximately 150°C.

17. Method as claimed in one of the claims 8 to 16,
characterized in that
the mold half (39) is removed from the base body (1) at a temperature of approximately 80°C.

18. Surface mounting optoelectronic component with
- a base body (1), which is formed from a thermoplast injection housing and a coated conductor strip (2),
- an optoelectronic transmitter and/or receiver (1) which is/are arranged in a recess (4) of the base body (1) and which is/are mounted on a portion (9) of the conductor strip (2) situated inside the recess (4),
- a transparent hardenable casting compound (14) that is provided in the recess, whose thermal characteristics are adapted to those of the thermoplast housing material, and
- an optical device (16,16') that covers the recess,
characterized in that
the optical device (16,16') and the casting compound (14) are cast on one another, so that the optical device enjoys surface-wide contact with the casting compound (14) in the region of said device's seating surface for placement onto the casting compound.

19. Surface mounting optoelectronic component as claimed in claim 18,
characterized in that
the recess (4) is provided with a surrounding ring channel (6).

20. Surface mounting optoelectronic component as claimed in one of the claims 18 or 19,

characterized in that

the base body (1) is provided with seating elements (32) for the optical device (16,16'), these being arranged at the margin side relative to the recess (4).

Abstract

Surface Mounting Optoelectronic Component and Method For Producing Same

A method for producing a surface mounting optoelectronic component comprises the following steps: readying a base body with the optoelectronic transmitter and/or receiver arranged in a recess of the base body, filling the recess of the base body with a transparent, curable casting compound, and placing the optical device onto the base body, whereby the optical device comes into contact with the casting compound.

Figure 2C

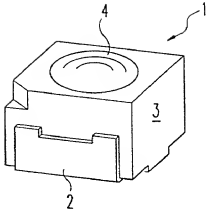


Fig. 1

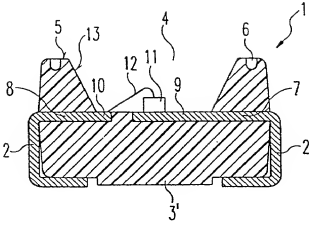


Fig. 2A

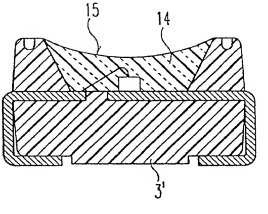


Fig. 2B

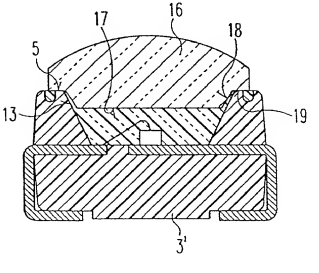


Fig. 2C

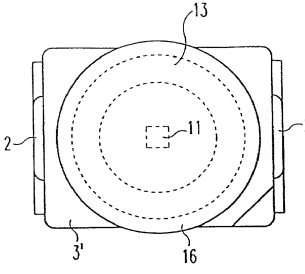


Fig. 3

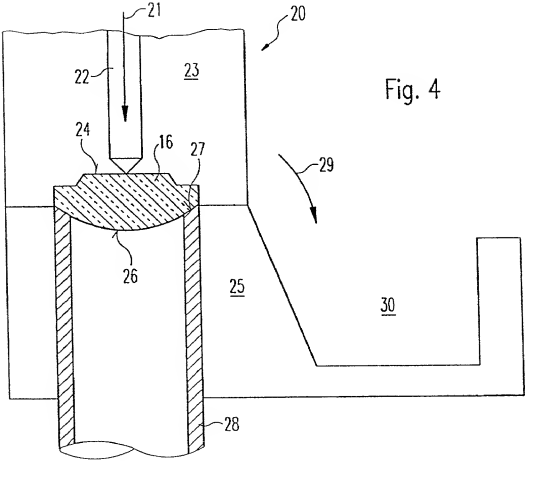


Fig. 4

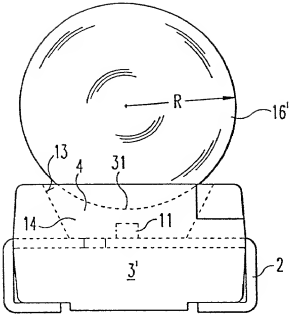


Fig. 5

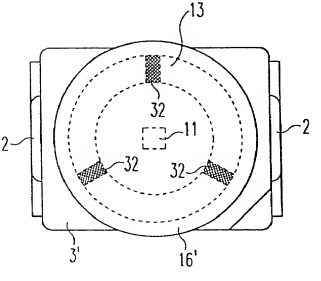


Fig. 6

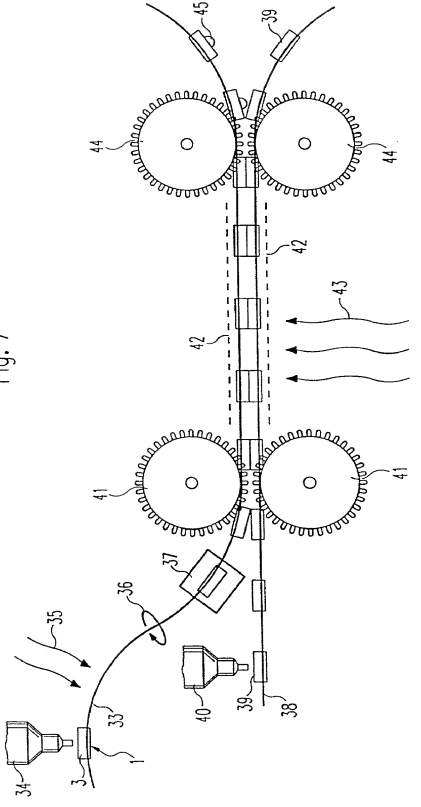


Fig. 7

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER P00,1088

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:
"SURFACE MUNTING OPTOELECTRONIC COMPONENT AND METHOD FOR PRODUCING SAME"
the specification of which (check only one item below):

- ☐ is attached hereto.
- ■ was filed as United States application
  Serial No. 09/581,585
  on June 15, 2000
  and was amended
  on June 15, 2000 (if applicable).
- ☐ was filed as PCT international application
  Number _____
  on _____
  and was amended under PCT Article 19
  on _____ (if applicable).

I hereby state that I have reviewed and understand the contest of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT International application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany	197 55 734.1	15.12.97	■ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO

Combined Declaration For Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NO.
P99,1086

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (If any)			

POWER OF ATTORNEY: And I hereby appoint Messrs. John D. Simpson (Registration No. 19,842), Steven H. Noll (28,982), Brett A. Valiquet (27,841), James D. Hobart (24,149), Melvin A. Robinson (31,870), and Mark Bergner (45,877), all members of the firm of Schiff, Hardin & Waite.

Send Correspondence to:
SCHIFF HARDIN & WAITE
PATENT DEPARTMENT
6600 Sears Tower, Chicago, Illinois 60606

Direct Telephone Calls to:
312/258-5790

201	FULL NAME OF INVENTOR	FAMILY NAME: WAITL	FIRST GIVEN NAME: GÜNTER	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY: Regensburg	STATE OR FOREIGN COUNTRY: Germany DEX	COUNTRY OF CITIZENSHIP: Germany
	POST OFFICE ADDRESS	POST OFFICE ADDRESS: Praschweg 3	CITY: Regensburg	STATE & ZIP CODE/COUNTRY: 93049 Regensburg Germany
202	FULL NAME OF INVENTOR	FAMILY NAME: LUTZ	FIRST GIVEN NAME: ROBERT	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY: Bad Abbach	STATE OR FOREIGN COUNTRY: Germany DEX	COUNTRY OF CITIZENSHIP: Germany
	POST OFFICE ADDRESS	POST OFFICE ADDRESS: Fuchsweg 24	CITY: Bad Abbach	STATE & ZIP CODE/COUNTRY: 93077 Bad Abbach Germany
203	FULL NAME OF INVENTOR	FAMILY NAME: BRUNNER	FIRST GIVEN NAME: HERBERT	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY: Regensburg	STATE OR FOREIGN COUNTRY: Germany DEX	COUNTRY OF CITIZENSHIP: Germany
	POST OFFICE ADDRESS	POST OFFICE ADDRESS: Kramgasse 7	CITY: Regensburg	STATE & ZIP CODE/COUNTRY: 93047 Regensburg, Germany

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 01.09.00	DATE 01.09.00	DATE 01.09.00